WHAT IS CLAIMED IS:

1. A method for monitoring the mechanical condition of a reciprocating compressor having a pressure-wrapped cylinder, the compressor including a plunger operable to reciprocate within the cylinder to cyclically compress a working fluid, thereby increasing the pressure of the fluid, an end assembly attached to one end of the cylinder, and at least one valve operable to facilitate fluid transfer between the cylinder and a source external to the cylinder, the method comprising:

measuring strain of at least one component of the end assembly as the plunger reciprocates within the cylinder, the at least one end assembly component experiencing a variable compressive force when the plunger reciprocates within the cylinder;

correlating the measured strain with a parameter related to plunger location, thereby facilitating generation of a strain profile; and

determining first and second pressure values, the first and second pressure values being related to the pressure in the cylinder when the plunger is at first and second locations, respectively, the determination of the first and second pressure values facilitating generation of a cylinder pressure profile based on the correlated measured strain.

2. The method of claim 1, further comprising:

sensing vibrations of the at least one valve; and

correlating the sensed vibrations with the parameter related to plunger location, thereby facilitating generation of a vibration profile.

3. The method of claim 1, wherein the strain is measured by a strain ring circumferentially disposed on the at least one end assembly component.

4. The method of claim 1, wherein the compressor further includes a crank assembly configured to cooperate with the plunger to transform rotational motion into linear motion of the plunger, the crank assembly including a

crank rotatably connected to a crankshaft, and wherein the parameter related to plunger location is a crank angle.

5. The method of claim 1, wherein the first and second pressure values are determined when the plunger is at bottom dead center and top dead center, respectively.

6. The method of claim 5, wherein the compressor further includes a suction line for intaking the working fluid into the cylinder, and a discharge line for discharging the working fluid from the cylinder, the method further comprising:

measuring the pressure in the suction line;

measuring the pressure in the discharge line; and

wherein the cylinder pressure when the plunger is at bottom dead center is assumed to be the suction line pressure, and the cylinder pressure when the plunger is at bottom dead center is assumed to be the discharge line pressure.

7. The method of claim 1, further comprising generating a cylinder pressure profile based on the correlated measured strain, the profile having one axis representing the cylinder pressure, and another axis representing the plunger location.

8. The method of claim 1, wherein the strain of two end assembly components is measured, and the method further comprises mathematically combining the two measured strains, thereby facilitating generation of a single strain profile for both measured strains.

9. The method of claim 1, wherein the end assembly includes a head at least partially disposed within the cylinder, the head being configured to facilitate fluid flow into the cylinder through the cylinder end, a flange, circumferentially disposed around a portion of the head and configured to retain the head at least partially within the cylinder, and a stud subassembly cooperating with

the cylinder to retain the flange adjacent the cylinder end, and wherein the strain is measured on a portion of the stud subassembly.

10. The method of claim 1 further comprising:

determining at least one compressor parameter, chosen from a set of compressor parameters, the set of compressor parameters including volumetric efficiency of the compressor, a closing angle of the at least one valve, a machine loading, and an indicated horsepower; and

correlating the at least one determined compressor parameter with the parameter related to plunger location, thereby facilitating generation of additional cylinder pressure profiles.

11. A system for using the method of claim 1, comprising:

a strain gauge configured to measure the strain of the at least one end assembly component and to output a signal related to the measured strain;

a first pressure sensor configured to measure pressure of the working fluid at a first location outside the cylinder, and to output a signal related to the measured pressure;

a second pressure sensor configured to measure pressure of the working fluid at a second location outside the cylinder, and to output a signal related to the measured pressure; and

a data acquisition subsystem configured to receive signals from the strain gauge and the pressure sensors, and to apply a preprogrammed algorithm to the signals received, thereby facilitating generation of the strain profile and the working fluid pressure profile.

12. The system of claim 11, further comprising a vibration sensor configured to sense vibrations of the at least one valve and to output a signal related to the sensed vibrations to the data acquisition subsystem.

13. The system of claim 11, wherein the strain gauge includes a ring gauge circumferentially disposed on the at least one end assembly component.

14. The system of claim 11, wherein the compressor further includes a crank assembly configured to cooperate with the plunger to transform rotational motion into linear motion of the plunger, the crank assembly including a crank rotatably connected to a crankshaft, the system further comprising a subsystem for determining crank position and outputting a signal related to the crank position to the data acquisition subsystem.

15. The system of claim 14, wherein the subsystem includes a proximity probe configured to detect a discontinuity in the crankshaft, thereby facilitating a determination of the crank position.

16. The system of claim 14, wherein the subsystem includes a magnetic pickup configured to detect a magnetic device disposed on the crankshaft, thereby facilitating a determination of the crank position.

17. The system of claim 11, wherein the compressor further includes a suction line for intaking the working fluid into the cylinder, and a discharge line for discharging the working fluid from the cylinder, and wherein the first pressure sensor is configured to measure the pressure of the working fluid in the suction line, and the second pressure sensor is configured to measure the pressure of the working fluid in the discharge line.

18. The system of claim 17, wherein the data acquisition subsystem is configured to correlate the suction line pressure with the cylinder pressure when the plunger is at bottom dead center, and to correlate the discharge line pressure with the cylinder pressure when the plunger is at top dead center.

19. The system of claim 11, wherein the data acquisition subsystem is configured to generate a cylinder pressure profile based on the correlated measured strain, the profile having one axis representing the cylinder pressure, and another axis representing the plunger location.

20. The system of claim 11, wherein the data acquisition subsystem is further configured to correlate at least one compressor parameter, chosen from a set of compressor parameters, to the parameter related to plunger location, thereby facilitating generation of additional cylinder pressure profiles, the set of compressor parameters including volumetric efficiency of the compressor, a closing angle of the at least one valve, a machine loading, and an indicated horsepower.